```
administrative routine  18 feb 1970

onn=335
lli=336
sd=302
uc=337
sr0=343
ntb=344
ubs=345
frp=346
qqt=347
bop=350
ctb=351
srr=356
mtt=357
bc=360
nuc=364
rs1=365
cpp=366         /process chain
c7=40000        /core 7

lok=770040
ulk=770041

nuf=20          /number of user fields

/process words

di1=6           /dia word
prn=7           /process ring
prq=11          /process queue

cms=6630        /origin of computation blocks
ffs=105         /file capability offset

dimension cns(1),cmp(1),prc(1)
dimension cpd(1),pdl(40)
pde=pdl+40

/console words

aw1=0           /assignment word
msk=3           /console mask
id=4            /pointer to ID
rr0=5           /reader switch
pp0=6           /punch switch
df1=7           /drum field table
```

```
/computation words

quu=11         /computation queue (two words)
bp1=13         /location of breakpoint
bp2=bp1+1      /proceed count
bp3=bp2+1      /instruction under breakpoint
ilr=bp3+1      /illegal instruction return
imr=ilr+1      /illegal memory reference return
sup=imr+1      /superior sphere
spe=sup+1      /fault entry to superior
be1=spe+1      /break enable
con=be1+2      /pointer back to console
prh=con+2      /process hoard

define die
               jmp .
terminate
```

```
                 offset 3200
100/
adr,             jmp .
                 jmp atm /meta instruction
                 jmp .
103,             770171  /wait for login/logout job
                 iam
                 eem
                 dac new
lgl,             lac new
                 xor old
                 CAIM|
                 jmp 103
                 SII
                 A←IAI
                 dac t66
                 xor old
                 dac old
                 A←IX
                 law 37
                 rir 7s
                 ril 1s
                 SAA
                 spi i
                 jmp .-3
                 dap vv1
                 add (c7 ctb-40
                 X→AX
                 lxr i 0
                 X→AX
                 ior (c7
                 dac cns
                 TXP
                 jmp on  /login

                 lac t66 /logout
                 cma
                 aam
                 and (c7 onn
                 aam
                 sad (c7 onn
                 jmp lgl /not logged in
                 aam
                 dac (c7 onn          /disable call button

/be sure to flush core 0 C-list so core 7 stuff can be deleted

                 lac vv1
                 mta 204 /delete ID and user
                 lac t66
                 cma
                 dac t1
                 jsp exm
                 lxr cns
                 lio i aw1
                 iot 677 /lar
                 iot 1577             /scn
                 rcl 4s
                 add (c7
aam
add (c7 bop
TAAX
lio i 6 /bip
dio i 0 /bop
iot 277 /bff
iot 1177            /ben
iot 77  /psf
cli
iot 677 /lar
iot 1577            /scn
jsp lxm
lxr cns
aam
lac (c7 lli
dac i rr0
dac i pp0
lac t1
and rw
dac rw
lac t1
and pw
dac pw
lac t1
and xrw
dac xrw /ext reg
jsp daf
jsp dxe
law i 200
and i aw1
dac i aw1           /dismiss ext reg
jmp lgl
```

```
on,           lac vv1
              mta 302 /create ID
              jmp noc
              lio (030000
              law 22
              xct vv1 /attach it
              die
              cla↓swp
              mta 1
              lio (250000
              mta 104 /read a copy of ID
              jmp .-1
              law 101
              mta
              lac (201272
              xct vv1 /set ill. inst. ret. for ID
              lac (203272
              xct vv1 /set ill. mem. ref. ret.
              law 202 /create a process for ID
              xct vv1
              jmp noc
              law idp /initialize process state
              mta
              law 52
              lio (1
              xct vv1
              die
              law 77
              and vv1
              ior (i
              TAX
              lac i 0
              and (7777
              lxr cns
              dac i id
              ior (c7
              X→AX
              dzm i sup           /erase its superior
              dzm i prh           /set its quota to one
              dap i con           /give ID a C-list
              lac (403372         /turn on PRL for ID
              xct vv1
              lio (100
              law 14
              mta
              lac (302272
              xct vv1 /create user for ID
              jmp noc
              lio (1450           /bring user into self at index 50
              law 242
              xct vv1
              die
              aam
              lac (010050
              and (7777
              ior (c7
              TAX
              lac cns
              dap i con           /give user a core 7 C-list
              law 202
              ivk 50  /create process for user
              jmp noc
              law 50
              mta 204 /erase copy of user
              law 12
              xct vv1 /start ID running
              lac t66
              aam
              ior (c7 onn
              aam
              dac (c7 onn
              jmp lgl

noc,          lac vv1 /can´t log in
              mta 204 /delete ID if created it
              law 50
              mta 204 /delete extra copy of user
              jmp lgl

/initial process state for ID

idp,          0       102         0
              0       0           0

t66,          0
new,          0
old,          0
vv1,          ivk .   /console number+36
```

```
/process list (used only for reference counts)

dimension ppf(100)
dimension iif(100)    /hardware device table

/programmed queue list

frq,          qqf+1
qqf,          1
              repeat 3,.+1
              0

/file list

frf,          fff     /free files
fff,          repeat 37,.+1
              0

/sphere list

frc,          ccf+2
ccf,          1       /adm rt
              1       /tape controller
              repeat 14,.+1
              0

/microtape list

mtu,          repeat 4,0

t0,           0
t,            0
t1,           0
t2,           0
t3,           0
t4,           0
t5,           0
t6,           0
t7,           0
t8,           0
t8+1,         0
cmq,          0
cmr,          0

/tabkes to rotate translation word

r1,           ril 3s  ril 6s      ril 9s
              rir 6s  rir 3s
r2,           nop
```

```
/set memory bound for computation in cmr(0)
/t5 = new bound

smb,            0
                lac cmr
                ior (c7
                TAX
                dzm t3
sm1,            law i 7777          /find present bound
                and i 1
                sza i
                jmp .+5
                SXX
                idx t3
                sas (6
                jmp sm1
                lac t3  /old bound
                sub t5  /new bound
                spq
                jmp ccc

                jsp exm /lower the bound
sm2,            lac t5
                add cmr
                dac t
                ior (c7
                dac t1
                sub t5
                dac t2
                lxr t1
                law i 7777
                and i 1
                spa
                jmp dpc /in core
                ral 6s
                and (37
                add (c7 sd-1
                jmp ct3
dpc,            aam
                lio t2
                lxr t5
                xct i r1
                law 7
                A←IA
                add (c7 bc
                TAAX
                lio (1000
                dio i 0 /give it high swap priority
                add (uc-bc

ct3,            TAX
                dzm i 0
                jdp ct1 /flush this core and attachments
                idx t5
                sas t3
                jmp sm2
                jsp lxm
sms,            idx smb
                jmp i smb
```

```
ccc,            sza i
                jmp sms /bound is unchanged

                dac t2  /raise the bound
                jsp exm
                lxr (c7 /count cores
                lio i uc
                sni
                idx t2
                lio i uc+1
                sni
                idx t2
                lac t2
                sma
                jmp sm4 /already have enough
                lxr (c7 sd          /count drum fields
sm3,            lac i 0
                and (377777
                sza i
                jmp .+5
                SXXA
                sas (c7 sd+26
                jmp sm3
                jmp smy /can't get enough
                isp t2
                jmp .-5
```

```
/create core fields

sm4,            lac cmr
                add t3  /core number
                dac t1
                ior (c7
                dac t2
                sub t3
                dac t0
                jdp dtc /remove attachment, if any
                law 0
                lxr (c7
                lio i uc
                sni
                jmp onc
                law 1
                lio i uc+1
                sni
                jmp onc
cr0,            jsp gaf /user field on drum
                jmp .   /can't allocate field?
                lac (lac
                aam
                dac afp
                lac afn /field no.
on2,            ior t1
                lxr t2
                dac i 1

                idx t3  /done
                sas t5
                jmp sm4
                idx smb
smy,            jsp lxm
                jmp i smb

onc,            lia
                add (c7 uc
                TAX
                lac t1
                dac i 0
                lai
                lxr t0
                lio i 0
                lxr t3
                xct i r1
                rcr 3s
                CXX
                xct i r2
                lxr t0
                dio i 0
                lac (400000
                jmp on2
```

```
/detach, core in t4, must not be real core
/comp in t0(7), t2 = t0 + t4, t1 = t2 ← 7777

/EXECUTIVE MODE

dtc,            0
                lxr t2
                lac i 1
                sza i
                jmp i dtc               /empty
                dap cc4
                dzm i 1
                ior (c7
                TAX
                law 7777
                and i 1
                sas t1
                jmp .-5
cc4,            law .
                dap i 1
                aam
                lio t0
                lxr t4
                xct i r1
                law 6
                rcr 3s
                CXX
                xct i r2
                aam
                dio t0
                jmp i dtc
```

```
/remove attachments from core+comp in t
/EXECUTIVE MODE

ct1,            0
                lac t
                dac t0
                and (7770
                TAAX
                ior (c7
                dac t2
                aam
                lio t2
                lac t0
                X$AX
                xct i r1
                law 6
                rcr 3s
                CXX
                xct i r2
                aam
                dio t2
                lac t0
                ior (c7
                TAX
                law 7777
                and i 1
                dzm i 1
ct2,            sas t
                jmp ct1+2
                jmp i ct1
```

```
/create a process for computation in cmq, skip if win.

crp,            0
                jsp exm
                law 7777
                and cmq
                ior (c7
                TAX
                lac i con
                sma
                jmp cpn /not stopped
                dac t4  /save PRL bit
                lio i prh
                TII_<
                jmp .+10                /hoard is not empty
                aam
                lio (c7 frp             /check pool
                sni
                jmp cpn /too bad
                law i 1
                adm i prh               /increase debt
                lxr (c7 frp-prh
                lac i prh
                ior (c7
                dac t5  /7pointer to proc
                aam
                lac t5
                dac i prh               /unlink it
                lac (c7
                A↓IX    /7pointer to proc
                law 7777
                and cmq
                dac i 5
                dac i prn
                ior (c7
                lia
                X→IX
                lac i prn+1
                swp
                dap i prn+1
                TAX
                lac t4
                raq 3s
                and (010000
                dac i 4 /set up PRL bit
                lai
                and (7777
                dac i prn+1
                ior (c7
                X→AX
                dap i prn
                idx crp
cpn,            jsp lxm
                jmp i crp
```

```
/delete process whose number is in t4 from computation in cmr(0)
/skip if win

dlp,            0
                jsp exm
                lio t4
                cmi
                lac cmr
                ior (c7
                TAX
                lac i con
                sma
                jmp dlz /not stopped
dl7,            law 7777
                and i prn
                sad cmr
                jmp dlz
                ior (c7
                X→AX
                SIIP
                jmp dl7
                TXXI
                dzm i prn+1
                lxr i prn           /remove from ring
                X→AX
                dap i prn
                and (7777
                ior (c7
                X→AX
                dap i prn+1
                TIIX
                lac i prq
                ral 1s
                spa
                jmp dlw /in enter wait
dl6,            aam     /delete it, 7pointer in XR
                lio (c7 frp
                dio i 0
                law 7777
                A←XA
                aam
                dac (c7 frp
                lac i prn
                dzm i prn
                and (740000
                sas (740000
                jmp dly
                law 7777            /restart for fork,
                and i dl1           /get extra process
                ior (c7
                TAX
                jmp dl6 /and return it
dly,            idx dlp
dlz,            jsp lxm
                jmp i dlp

dlw,            lxr (c7 cpp-prq     /need to search proc chain
dl2,            law 7777
                and i prq
```

```
sad (cpp-prq
jmp dly
ior (c7
X→AX
X$IP
jmp dl2 /no
lxr i prq           /yes, remove it
X→AX
and (7777
dap i prq
sas (cpp-prq
jmp .+5
law 7777
A←XA
aam
dac (c7 cpp+1
TIX
dzm i prq
jmp dl6
```

```
acr,            lac cmr /arg processor
                ior (c7
                TAX
                law 7777
                and i con
                ior (c7
                dac cns
                lac ac
                dac t3
                lxr cns
                lia
                spa
                cma
                dac t2  /| AC|
                lac i msk
                dac t
                cma
                dac t1
                law cod
                dap arl
arl,            lac .
                sza i
                jmp ppq
                sad t2
                jmp arf
                law 2
                adm arl
                jmp arl
arf,            idx arl
                xct arl
                spi i
                raq 9s
                and (777
                add arn
                dap . 1
                jnp .

ppq,            law flexo  q
                xor t2
                and (777770
                sza
arn,            jmp err
                law 7   /q1 to q7
                and t2
                sza i
                jmp err
                sub (10
                TAX
                lac (400000
                ral 1s
                SXXP
                jmp .-2
                lxr cns
                spi i
                jmp .+4
                cma      /dismiss
                and i aw1
                jnp ppr
                lia      /assign
```

```
                  and i aw1
                  A←IP
                  jmp yes /already assigned
                  lai
                  and xaw
                  sza
                  jmp no  /can´t
                  lah
                  ior i aw1
ppr,              lia
                  xor i aw1
                  xor xaw
                  dac xaw
                  dio i aw1
                  lio t3
                  spi
                  jmp no
                  jmp yes

define f x,p,m
                  flexo  x
[p-err]*1000 m-err
terminate
```

```
/arq dispatch table

cod,          f  r,pr,mr
              f  p,pp,mp
              f af,paf,maf
              f 1f,p1f,m1f
              f xf,pxf,err
              f tf,ptf,err
              f  f,pff,mff
              f ax,pax,err
              f sx,sax,err
              f  x,err,max
              f  q,err,mq
              f nf,pnf,err
              0

ye3,          lac pfn /return PF in AC and skip
              rar 6s
              dac ac
yes,          lac t0
              cma
              jmp no2

no1,          dac ac
no,           lac t0
no2,          sma
              jmp rtm
              jmp rts
```

```
/arq routines

err,            jmp ill /arq is illegal

/+r
pr,             lac t1
                and rw
                sza
                jmp no
                lac t
                dac rw
                lac (skp
                dac i rr0
                aam
                lac (c7 rs1
                ior (c7
                TAX
                aam
                lac (c7 sr0
                dap i 0
                jmp yes

/-r
mr,             aam
                lac (c7 lli
                dac i rr0
                lac t1
                and rw
                dac rw
                sza
                jmp no
                aan
                lac (c7 srr
                ior (c7
                TAX
                dap i 0
                aam
                lac (c7 rs1
                ior (c7
                TAX
                aam
                lac (c7 sr0
                dap i 0
                jmp no

rw,             0         /reader word
```

```
/+p
pp,             lac t1
                and pw
                sza
                jmp no
                lac t
                dac pw
                lac (skp
                dac i pp0
                jmp yes

/-p
mp,             aam
                lac (c7 lli
                dac i pp0
                lac t1
                and pw
                dac pw
                jmp no

pw,             0          /punch word

/+nf
pnf,            lxr (c7 sd
                dzm t2
pn1,            lac i 0
                and t
                sza
                idx t2
                SXXA
                sas (c7 sd+26
                jmp pn1
                lac t2
                rar 6s
                jmp no1
```

```
/+tf
ptf,            lxr prc
                dzm i 0
                lax 77
                and io
                lxr cns
                jda pfn
                aam
                lac pfp
                and (77
                rar 6s
                jmp no1

/+xf
pxf,            cla
                lio io
                rcl 6s
                jda pfn
                lio pfp
                dio t
                law 77
                and io
                jda pfn
                nam
                lac i t
                lio i pfp
                dio i t
                dac i pfp
                iam
                jmp yes
```

```
/+1f
p1f,       jsp gaf
           jmp no
           jsp gpf
           jmp no
           law 0440
           ior afn
           ral 6s
           lia
           jmp as3

/-1f
m1f,       law i nuf
           dac t2
           lac i df1
           ior (c7
           dac pfp
m1f+5,     law i 1
           adm pfp
           aam
           lac pfp
           sza
           jmp m12
m12-3,     isp t2
           jmp m1f+5
           jmp no
m12,       and (077777
           aam
           sas pfp
           jmp m12-3       /not a drum field
           and (77
           rar 6s
           jda afn
           jmp dsf

/+af
paf,       ZAP
```

```
/-af
maf,            law 600
                dap dss
                law 77
                and io
                sza i
                jmp af2
                jda pfn
af1,            lac pfn
                dac t4
                law i 7777
                and io
                sza i
                jmp af4
af3-1,          jda afn
af3,            lac t4
                jda pfn
dss,            skp
                jmp asf
                jmp dsf

af4,            law 77  /fill AG
                and io
                jda pfn
                lac (077777
                aam
                and pfp
                aam
                sas pfp
                jmp no  /is not a field
                sza
                jmp af7 /PF was assigned, use its AF
                xct dss
                jsp gaf /PF not assigned, get new AF
                jmp no
                jmp af3

af7,            and (77
                rar 6s
                jmp af3-1

af2,            law i 7777          /fill PF
                and io
                sza i
                jmp yes /both are zero
                jda afn
                aam
                lac afp
                and t
                sza i
                jmp af5
                law i nuf           /AF was assigned, find its PF
                add i df1
                ior (c7
                dac pfp
apr,            aam
                lac pfp
                rar 6s
                xor (0440
                sad afn
                jmp af6
                idx pfp
                and (7777
                sas i df1
                jmp apr
                jmp .   /can´t find it

af5,            xct dss /AF was not assigned, get new PF
                jsp gpf
                jmp no
                jmp af1
af6,            jsp pfp+1
                jmp af1
```

```
/-q
mq,             jsp dxe
                jmp no

/-f
mff,            jsp daf
                jmp yes

/+f
pff,            law i 7777
                and io
                sza i
                jmp yes
                ral 6s
                cma
                dac t1
                dac t2
                dac t3
                jsp gaf
                jmp no
                law i 1
                adm apx
                isp t1
                jmp ga7
                jsp gpf
                jmp no
                law i 1
                adm ppx
                isp t3
                jmp gp7
ffl,            jsp gaf
                jmp .
                jsp gpf
                jmp .
                law 177
                nam
                and i afp
                ior t
                dac i afp
                law 0440
                xor afn
                ral 6s
                dip i pfp
                iam
                isp t2
                jmp ffl
                jmp yes
```

```
/+ax
pax,            ZAP

/+sx
sax,            lac (add
                dac t2
                lac t1
                and xrw
                lia
                and t2
                swp
                and (177
                sza↓sni
                jmp no
                law 177
                and xrw
                ior t
                ior t2
                dac xrw
                law 200
                lxr cns
                ior i aw1
                dac i aw1
                jmp yes

/-x
max,            lac t1
                and xrw
                dac xrw
                law i 200
                lxr cns
                and i aw1
                dac i aw1
                jmp no

xrw,            0        /ext. reg. word

dxe,            dap dxx /dismiss external eq.
                lxr cns
                lac i aw1
                xor xaw
                dac xaw
                law i 177
                and i aw1
                dac i aw1
dxx,            jmp .

xaw,            0        /external assignment word
```

```
daf,            dap dfx /dismiss all fields
                law i nuf
                dac t2
                add i df1
                ior (c7
                dac pfp
                nam
                lac (700000
                and i pfp
                sza i   /don't delete other capabilities
                dzm i pfp
                idx pfp
                isp t2
                jmp .-6
                lac (c7 sd
                dac afp
                lac t1
                and i afp
                dac i afp
                idx afp
                sas (c7 sd+26
                jmp .-5
                iam
dfx,            jmp .

dsf,            aam     /dismiss field
                lac pfp
                rar 6s
                xor (0440
                sas afn
                jmp no
                lac t1
                nam
                and i afp
                dac i afp
                dzm i pfp
                iam
                jmp yes

asf,            law 0440
                ior afn
                ral 6s
                lia
                lac t1
                aam
                and afp
                and (lac 177
                sza
                jmp no  /can't get it
                aam
                lac pfp
                sza
                jmp at2
                lac t
                aam
                and afp
                sza
                jmp no
as3,            law 177
```

```
                nam
                and i afp
                ior t
                dac i afp
                dio i pfp
                iam
                jmp ye3

as2,            A$IP|
                jmp as3
                jmp no
```

```
afp,            0         /afp→afn
                dap apx
afp+2,          lac (-c7-sd+1
                add afp
                rar 6s
                dip afn
apx,            jmp .

afn,            0         /afn→afp
                dap anx
                lac afn
                sza i
                jmp no
                ral 6s
                sub (27
                sma
                jmp no
                add (c7 sd 26
                d+p afp
anx,            jmp .

pfp,            0         /pfp→pfn
                dap ppx
pfp+2,          lac pfp
                sub i df1
                add (nuf-c7
                dac pfn
ppx,            jmp .

pfn,            0         /pfn→pfp
                dap pnx
                lac pfn
                sza i
                jmp no
                sub (nuf
                sma
                jmp no
                add i df1
                ior (c7
                dac pfp
pnx,            jmp .

gaf,            dap apx /get absolute field
                lac (c7 sd
                dac afp
gaf+3,          aam
                lac afp
                sza i
                jmp ga2
ga7,            idx afp
                sas (c7 sd 26
                jmp gaf 3
                jmp apx
ga2,            idx apx
                jmp afp 2

gpf,            dap ppx /get pseudo field
                law i nuf-1
                add i df1
                ior (c7
                dac pfp
gpf+5,          aam
                lac pfp
                sza i
                jmp gp2
gp7,            idx pfp
                and (7777
                sas i df1
                jmp gpf 5
                jmp ppx
gp2,            idx ppx
                jmp pfp 2
```

```
/create capability

cra,            0
                dap cax
                law 7777
                and cmp /crock so create sphere will work
                jdp fcl
                sza i
                jmp cax /no C-list
                sub (1
                and ac
                dac t2  /requested index number
                dac t1
ca1,            aed clp
                TAX
                lac i 0
                TAP|
                jmp ca2
                sas t2  /not free
cax,            jmp .
                idx t1  /asked for zero
                sas cls
                jmp ca1
                jmp cax
ca2,            lac cra
                dac i 0
                lac t1
                dac ac
                idx cax
                jmp cax
```

```
/meta instructions and ivks
/transmitted word = +0 for arq, -0 for arq i,
/20_<T_<77 for meta, T_>100 for ivk w/c7 C-list
/T<0 for c0 C-list (aedr-70000)

atm,            iam
                aem
                TAX
                law i 2
                sas ff
                jmp .-1
                isp ff
                jmp .+4
                law i 1
                adm ff
                jmp .-7
                dio t0
                TXA
                dap enp /set up entered process
                ior (10000
                TAX
                law 7777
                and i 0
                ior (c7
                dac prc
                TAX
                sad i prn+1
                jmp ill /process has been acandoned
                lac i 5
                dac cmr
                ior (c7
                TAX
                lio i con
                law 21
                spi
                jmp enp /sphere is stopped
                lio (ac
                law 1
                xct enp /read live registers
                lac t0
                TAA|=
                jmp aqr
                and (77
                sas t0
                jmp iv2 /ivk
mtb,            law i 20           /meta
                add t0
                TAAX>P
                jmp ill
                sub (30
                sma
                jmp ill /illegal number
                lac cmr /computation to which meta refers
                ior (240000
                aam
                dac (i 71
                lac cmr
                ior (c7
                dac cmp
                lac ac
                xct i .+1
                jmp m20
                jmp m21
                jmp m22
                jmp m23
                jmp m24
                jmp m25
                jmp m26
                jmp m27
                jmp ill
                jmp ill
                jmp m32
                jmp m33
                jmp ill
                jmp m35
                jmp m36
                jmp m37
                jmp m40
                jmp m41
                jmp m42
                jmp m43
                jmp m44
                jmp m45
                jmp m46
                jmp m47

ill,            law 41
enp,            ivk
                law i 1
                adm ff
                qit

ac,             0
io,             0
ff,             -2
```

```
/mta 200 - read illegal instruction return

m20,            lxr cmp
                lac i ilr
                dac ac

rtm,            lio (ac /return, no skip
                law 11
                xct enp
                law 31
                jmp enp

/mta 201 - set illegal instruction return

m21,            lxr cmp
                dac i ilr
                jmp rtm

/mta 202 - read memory protection return

m22,            lxr cmp
                lac i imr
                jmp m20+2

/mta 203 - set memory protection return

m23,            lxr cmp
                dac i imr
                jmp rtm
```

```
/mta 204 - release capability

m24,            lac cmr
                jdp fcl
                sza i
                jmp rtm /no C-list
                sub (1
                and ac
                add clp
                TAX
                lac i 0
                and (700000
                sza i
                jmp rtm
                lac i 0
                dzm i 0
                jda rmv
                jmp rtm

/mta 205 - detach

m25,            and (070000
                ral 6s
                sza i
                lac ac
                and (7
                dac t4
                sub (6
                sma
                jnp rts /if illegal, ok
                lac cmr
                add t4
                dac t1
                ior (c7
                dac t2
                sub t4
                dac t0
                lxr t2
                law i 7777
                and i 1
                sza
                jmp rtm /is a real core, fail
                jsp exm
                jdp dtc
                jsp lxm
                jmp rts

/mta 206 - read memory bound

m26,            law i 6
                dac t3
                dzm t1
                dzm t2
                lxr cmp
rd1,            lac t2
                adm t2
                law i 7777
                and i 1
                sza i
                jmp rd4
                idx t1  /real core
rd3,            SXX
                isp t3
                jmp rd1
                lac t2  /attachments
                ral 6s
                ior t1  /memory bound
                rar 6s
                dac ac
                jmp rtm
rd4,            lac i 1
                sza
                idx t2
                jmp rd3

/mta 207 - set memory bound

m27,            and (070000
                ral 6s
                sza i
                lac ac
                and (7
                dac t5
                sza
                sub (7
                sma
                jmp rtm
                jdp smb
                jmp rtm
                jmp rts
```

```
/mta 302 - create sphere

m32,            law 7777
                and cmp
                dac cmq
                lac frc
                sza i
                jmp rtm /can´t
                mul (30>2
                lai
                add (cms-ccf*30
                dac cmr
                ior (c7
                TAX
z=1             repeat 6,dzm i z     z=z+1
                lio (666666
                dio i 0
                law 1
                dac t5  /initial memory bound
                jdp smb
                jmp rtm
                lac cmr
                ior (c7
                TAX
                lac (400000
                dac i bp1
                dzm i bp2
                dzm i bp3
                lac cmq
                dac i sup
                lac io
                and (077777
                dac i spe
                clc
                dac i ilr
                dac i imr
                dzm i be1
                lac (400000
                dac i con
                dzm i prh
                dzm i quu
                dzm i quu+1
                lac cmr
                dac i prn
                dac i prn+1
                ior (240000
                jda cra
                jmp .+7
                lxr frc
                lio i 0
                law 1
                dac i 0
                dio frc
                jmp rts
                dzm t5
                jdp smb
                nop
                jmp rtm
```

```
/mta 303 - create queue

m33,            lac frq
                sza i
                jmp rtm /can´t get one
                sal 1s
                add (-prq+340000-qqf*2
                aam
                add (c7 qqt
                jda cra
                jmp rtm /can´t find space
                lax 7777
                and cra
                TAAX
                ior (c7
                X→AX
                dac i prq+1          /initialize it
                lio io
                TII<
                CII=
                lai
                dac i prq
                lxr frq
                lio i 0
                law 1
                dac i 0
                dio frq

rts,            lio (ac /return, skip
                law 11
                xct enp
                law 51
                jmp enp
```

```
/mta 305 - create file

m35,           lac frf
               sza i
               jmp rtm
               mul (3
               scr 1s
               lai
               add (ffs+540000-fff*3
               jda cra
               jmp rtm
               lxr frf
               lio i 0
               law 1
               dac i 0
               dio frf
               jmp rts

/mta 306 - create IO device

m36,           lac ac
               ral 6s
               and (7
               TAX
               lac ac
               rar 6s
               TXP|
               jmp 36a
               jmp 36b

36a,           and (3
               dac t4
               TAAX
               lio i mtu
               sni i
               jmp rtm /not available
               ral 3s
               ior (714000
               jda cra
               jmp rtm
               lxr t4
               idx i mtu
               jmp rts

36b,           and (77
               ior (600000
               jda cra
               jmp rtm
               jmp rts

m37,           jmp ill
```

```
/mta 400 - read capability

m40,            lac cmr
                jdp fcl
                sza i
                jmp rtm /no C-list
                sub (1
                and ac
                add clp
                TAX
                lac i 0
                dac ac
                jmp rts

/mta 401 - exchange capabilities

m41,            lac cmr
                jdp fcl
                sza i
                jmp rtm /no C-list
                sub (1
                lia
                and ac
                add clp
                dac t1
                lac ac
                rar 6s
                A←IA
                add clp
                TAX
                lac i 0
                aam
                lio t1
                aam
                dac t1
                dio i 0
                jmp rts
```

```
/mta 402 - turn PRL off

m42,            lxr cmp
                lac (200000
                adm i con
                dac t7
                ral 2s
                sma
                jmp 42d /already off
                law 2
                ivk 71  /suppress processing
                lac cmr
                ior (240000
                lem
                jda gcp
                dac t8
                dzm t8+1
                stf 5
                lem
                lxr (t8
                jdp ssr
                jmp .+4
                lac gcp
                jda rmv /doesn´t mind lem
                jmp .-7 /returns in eem
                eem
/cmr is now clobbered
                lxr cmp
                lac (-100000
                adm i con
42b,            law 7777
                and i prn
                ior (c7
                sad cmp
                jmp 42c
                TAX
                lac (-010000
                and i 4
                dac i 4
                jmp 42b
42c,            lio t7
                law 12
                spi i
                ivk 71
42d,            lxr cmp
                lac (-200000
                adm i con
                jmp rtm
```

```
/mta 403 - turn on PRL

m43,            lac cmr
                ior (c7
                TAX
                lac (200000
                adm i con
                dac t3
                ral 2s
                spa
                jmp 43d /already on
                law 2
                ivk 71  /suppress processing
                jsp exm
                lac cmr
                ior (c7
                TAX
                lac (100000
                adm i con
43b,            law 7777
                and i prn
                sad cmr
                jmp 43c
                ior (c7
                TAX
                lac (010000
                ior i 4
                dac i 4
                jmp 43b
43c,            law 43f
                dac ct1
                lac cmr
                dac t
                ior (c7
                TAX
                law 7777
                and i 1
                X→AH
                dap i 1
                lai
                jmp ct2 /force off attachments (too bad)
43f,            jtp lxm
                law 22
                lio (020000
                ivk 71  /attach
                die
                TIX
                dzm i 0 /cleaq C-list
                SXXA
                sas (020100
                jmp .-3
                lio t3
                law 12
                spi i
                ivk 71  /permit processing
43d,            lac cmr
                ior (c7
                TAX
                lac (-200000
adm i con
jmp rtm
```

```
m44,            jmp ill
m45,            lxr cmp /405 - read hoard size
                lac i prh
                dac ac
                spq
                jmp rtm
                dzm ac
                sza i
                jmp rtm
                ior (c7
                TAX
                idx ac
                lac i 0
                jmp .-6
m46,            lxr cmp /406 - decrease hoard
                lac i prh
                szm
                jmp .+4
                law i 1
                adm i prh
                jmp rtm
                dac t0
                ior (c7
                dac t1
                aam
                lio t1
                dio i prh
                aam
                lac (c7 frp
                aam
                dac t1
                lac t0
                aam
                dac (c7 frp
                jmp rtm
m47,            lxr cmp /407 - increase hoard
                lac i prh
                sma
                jmp .+3
                idx i prh
                jmp rts
                aam
                lio (c7 frp
                sni
                jmp rtm /too bad
                dio i prh
                swp
                ior (c7
                TAX
                lac i 0
                dio i 0
                aam
                dac (c7 frp
                jmp rts
```

```
/translate capability word in AC into object pointer
/in AC, tt0

gcp,            0
                dap gpx
                cli
                lac gcp
                rcl 3s
                law 7777
                and gcp
                TIX
                xct i ,+1
                die
                jmp gs1
                jmp gs2
                jmp gs3
                die
                jmp gs5
                jmp gs6
                jmp gs7

gs1,            sub (cms-[ppf+100]*13           /antered process
                mul (1
                div (13
                die
                sni i
                die
                TAAX
                lio gcp
                ril 5s
                law 1
                /spi
                dac i 0 /set ref. count to 1
                TXA
                ior (020000
                jmp ssy

gs2,            sub (cms-ccf*30     /sphere
                mul (1
                div (30
                die
                sni i
                die
                ior (040000
                jmp ssy

gs3,            sub (-prq-qqf*2     /queue
                lxr (c7
                sub i qqt
                mul (1
                div (2
                die
                sni i
                die
                ior (060000
                jmp ssy
```

```
gs5,            sub (ffs-fff*3      /file
                mul (1
                div (3
                die
                sni i
                die
                ior (120000
                jmp ssy

gs6,            and (77 /hardware device
                add (iif
                TAAX
                lio (1
                dio i 0 /make reference count = 1
                ior (140000
                jmp ssy

gs7,            rar 3s  /magnetic tape
                and (3
                add (mtu
                ior (160000
ssy,            dac ;tt0
                law 377
                aam
                and tt0
                sza i
                die      /count=0
                lac tt0
gpx,            jmp .
```

```
/get sub-object, <XR> has object pointer, <XR+1> has
/index of sub-object, initially 0, gets advanced to
/next one, skips if sub-object available, pointer in AC
/F5 → remove it
/XR saved

ssr,            0
                TXXA
                dac ;xrs
                lac i 0
                ral 2s
                cli
                rcl 3s
                TIX     /type
                sar 5s  /pointer
                xct i .+1

                die
                jmp ssx /1 - entered process
                jmp sb2 /2 - sphere
                jmp ssx /3 - queue
                die
                jmp ssx /5 - file
                jmp ssx /6 - hardware device
                jmp ssx /7 - entry

sb2,            mul (15
                lai
                add (cms-ccf*30
                eem
                jdp fcl
                lem
sbb,            lxr xrs
                lac i 1
                sub cls
                sma
                jmp ssx
                idx i 1
                sub (1
                add clp
                TAX
                lac i 0
                and (700000          /to ignore drum fields
                sza i
                jmp sbb
                lac i 0
                dac t1
                szf 5
                dzm i 0
                jda gcp
                idx ssr
                lac tt0
ssx,            lxr xrs
                jmp i ssr
```

```
/remove reference to capability given in AC
/must have already been removed from C-list

rmv,            0
                dap rmx
                lem
                lac rmv
                jda gcp
                d+c ;tt1
                law pdl /clear pdl completely
                dac cpd

/begin mark phase

gm0,            lxr cpd /clear pdl down to thing being deleted
                clf 6
                clf 5
                law 377
                aam
                and tt1
                sad (1
                jmp gwn
                sza i
                die      /count=0
                lac tt1
                dac i 0
gm1,            law 400
                aam
                adm i 0 /mark it
                and (177400
                sza i
                die      /mark overflow
                sas (400
                jmp gm2
                dzm i 1 /first time
                lac (177777
                aam
                and i 0
                aam
                dac i 0
gm3,            jep ssr
                jmp gm2
                dac i 2
                law 2
                A+XXA
                sad (pde
                die      /pdl overflow
                jmp gm1
gm2,            lac cpd
                X$AP|
                jmp gg1 /empty, begin check phase
                law i 2
                X+AX
                jmp gm3
```

/check for external references to A

```
gg1,        aam     /check B
            lac i 0
            spa
            jmp gg9 /P[B] already on, return
            and (177777
            cli
            rcr 8s
            ril 8s  /mark in AC, count in IO
            sza i
            jmp gg4 /checked already, continue only if turning on P[B]
            AMIA_<
            die     /mark > count
            and (400000         /sign bit if external reference
            ior i 0
            dac i 0 /turn on F
            sma
            jmp gg3
gg2,        and (177777         /B has external reference
            sad tt1
            stf 6   /B = A, can´t erase A
            lac (400000
            aam
            ior i 0
            aam
            dac i 0 /1 → P[B]
gg3,        dzm i 1 /sub-object index
            lac (-177400
            aam
            and i 0
            aam
            dac i 0 /clear mark field
gg5,        jdp ssr /get sub-object
            jmp gg8 /ran out
            lia
            lac i 0
            and (400000
            A↓II    /preserve F during push
            law 2
            A+XXA
            sad (pde
            die
            dio i 0
            jmp gg1 /recurse
gg4,        lac i 0
            spa
            jmp gg2
gg9,        lac cpd /pop, restore F
            X$AP|
            jmp gg6 /finished
            law i 2
            A+XX
            jmp gg5
```

```
gg6,          lac i 0
              and (177777
              sas tt1
              die
gwn,          lax i 1
              aam
              adm tt1 /decrease count
              szf 6
              jmp gk9 /it has external references

              lac tt1 /can delete it
              dac i 0
              dzm i 1
gk0,          stf 5
              jdp ssr /find and erate a sub-object
              jmp gh3
              dac tt1
              law 2
              adm cpd
              sae (pde
              die
              jmp gm0 /erase it

gh3,          law 377
              aam
              and i 0
              sza
              die     /count not 0
              lac i 0
              lio cpd
              lxr (pdl
              X$IP|
              jmp .+6
              sad i 0
              jmp gk9 /is on pdl from before
              SXX
              SXX
              jmp .-6
```

```
/delete object in AC

                dac tt0
                ral 2s
                cli
                rcl 3s
                TIX
                law 7777
                and tt0
                mul i gzz
                scr 1s
                lai
                add i gyy
                eem
                aam
                dac (010076
                lem
                law 7777
                and tt0
                xct i .+1
                die
                jmp gk1
                jmp gk2
                jmp gk3
                die
                jmp gk5
                jmp gk6
                jmp gk7

gk1,            law 41  /process
                ivk 76
                jmp gk9

gk2,            TAXI    /sphere
                lac frc
                dac i 0
                dio frc
                law 2
                ivk 76  /stop
                eem
                aam
                lac (010076
                and (7777
                dac cmr
                dzm t5
                jdp smb /set memory bound to 0
                nop
                dzm t4
                jsp exm
gq2,            lac cmr
                add t4
                dac t1
                ior (c7
                dac t2
                sub t4
                dac t0
                jdp dtc /remove attachment
                idx t4
                sas (6
                jmp gq2
                jsp lxm
                law 1
                dac t4
                jdp dlp /delete first process
                skp i
                jmp .-2
                jsp exm /clean off process hoard
                lac cmr
                ior (c7
                TAX
                lac i prh
                spq
                jmp gq5
                dac t0
                and (7777
                ior (c7
                TAX
                lac i 0
                sza
                jmp .-5
                aam
                lac (c7 frp
                dac i 0
                lac t0
                aam
                dac (c7 frp
gq5,            jsp lxm
                lem
                jmp gk9

gk3,            TAXI     /queue
                lac frq
                dac i 0
                dio frq
                lxr (c7
                lac i qqt
                lxr (010076
                adm i 0
                law 23
                ivk 76  /empty it
                jmp .-1
                jmp gk9

gk5,            TAXI     /file
                lac frf
                dac i 0
                dio frf
                jmp gk9

gk6,            jmp gk9 /hardware device

gk7,            TAXI     /mag tape
                dam i 0

gk9,            law i 2
                adm cpd
                TAAX
                sas (pdl-2
                jmp gk0
                aem
rmx,            jmp  .

gzz,            0
                13
                30
                2
                0
                3
                0
                10

gyy,            0
                cms-[ppf+100]*13+050000
                cms-ccf*30+240000
                -prq-qqf*2+340000
                0
                ffs-fff*3+540000
                0
                -mtu*10+714000
```

```
iv2,            lac t0
                spa
                jmp .+5
                add (c7
                TAX       /absolute pointer to capability
                lio i 0
                jmp iv3
                lac cmr /core 0 C-list
                ior (240000
                aam
                dac (i 76
                law buf
                mta
                cli
                lac (010102
                ivk 76
                jmp .-1
                lac (070000
                add t0
                TAX
                lio i buf
iv3,            dio t   /capability word
                law 7777
                A←IAP|
                jmp ill
                dac cmq /low 12 bits of capability
                cla
                rcl 3s
                TAAXI
                xor ac
                rcr 3s
                A→IP
                jmp ill /improper code
                xct i .+1

                jnp ill /0
                jmp ill /1
                jmp ifs /2 - sphere
                jmp ill /3
                jmp ill /4
                jmp ill /5
                jmp ill /6
                jmp ill /7

ifs,            and (77 /sphere ivk
                TAX
                lac cmr
                dac cmp /sphere executing the ivk
                lac cmq
                dac cmr /0pointer to sphere
                ior (c7
                dac t1  /7pointer to sphere
                law 60
                A←XP|
                jmp ill
                lax 7
                A←XX
                xct i .+1
                jmp c20 /202 - create process
jmp c21 /212 - delete process
jmp c22 /222 - count processes
jmp ill
jmp c24 /242 - antigrant
jmp c25 /252 - grant
jmp ill
jmp c27 /272 - execute nata
```

```
c20,          jdp crp
              jmp rtm
              jmp rts

c21,          lio io
              dio t4
              jdp dlp
              jmp rtm
              jmp rts

c22,          jsp exm
              lac cmq
              ZIP
              SII
              ior (c7
              TAX
              law 7777
              and i prn
              sas cmq
              jmp .-6
              dio ac
              jsp lxm
              jmp rtm
```

```
c24,            lac cmr
                jmp .+4

c25,            lio cmr
                lac cmp
                dio cmp /receiver
                lio io
                dio ac
                jdp fcl /sender
                sza i
                jmp rtm /no C-list in sender
                sub (1
                lio ac
                rir 6s
                A←IA
                add clp
                TAX
                lac i 0
                dac cra /capability to be moved
                and (7777
                sza i
                jmp rtm /nothing
                lac cra
                and (700000
                sza
                sad (100000
                jmp rtm /can´t do this yet
                jsp cra+1
                jmp rtm /couldn´t receive it
                lem
                lac cra
                jda gcp
                aam
                idx tt0 /index count
                eem
                jmp rts`

c27,            lac ac
                ral 9s
                ior (70
                lia
                rar 3s
                A←IA
                and (77
                dac t0  /code number
                lxr prc
                lac i di1
                dac ac  /new AC
                jmp mtb
```

```
/find C-list of computation in AC(0)
/returns pointer to origin in clp
/returns size (0,20,cr 100) in cls, AC

fcl,            0
                ior (240000
                aam
                dac (010073
                and (7777
                ior (c7
                TAX
                law 100
                dac cls
                lac i con
                ral 2s
                spa
                jmp fl3 /core 0 C-list
                dzm cls
                law 7777
                and i con
                sza i
                jnp fl4 /no C-list
                ior (c7 /core 7 C-list
                TAX
                law nuf
                dac cls
                lac i df1
                add (c7-nuf
fl4,            dac clp
                lac cls
                jmp i fcl

fl3,            lio (020000         /core 0 C-list
                law 22
                ivk 73  /attach
                die
                lac (020000
                jmp fl4

dimension clt(1),clp(1)
```

```
/enter executive mode

exm,            dap ex9
                lxr (c7
                lok
                lio i 107
                dio ;ex1
                lio i 110
                dio ;ex2
                lio i 111
                dio ;ex3
                lio (eem
                dio i 107
                lio (jmp i 111
                dio i 110
                law ex8
                dac i 111
                hlt
lx9,            jmp .
ex8,            eem
                lxr (c7
                lio ex1
                dio i 107
                lio ex2
                dio i 110
                lio ex3
                dio i 111
ex9,            jmp .

/leave executive mode

lxm,            dap lx9
                jmp i (70000+ubs

constants
printo .+3200 printc 77
variables
buf,
start
```